

Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.



FARMERS' BULLETIN



WASHINGTON, D. C.

649

FEBRUARY 27, 1915.

Contribution from the Bureau of Entomology, L. O. Howard, Chief.

ALFALFA ATTACKED BY THE CLOVER-ROOT CURCULIO.

By F. M. WEBSTER,
In Charge of Cereal and Forage Insect Investigations.

INTRODUCTION.

The clover-root curculio¹ is of foreign origin and was not known to occur in America prior to 1876, when the late Dr. John LeConte found the beetles about the roots of grass growing on sand dunes at

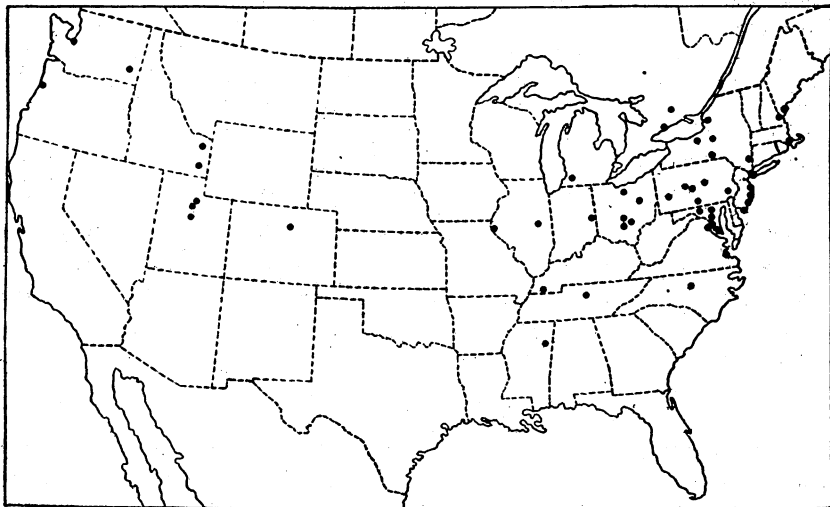


FIG. 1.—Present known distribution in the United States of the clover-root curculio. (Original.)

Long Branch, N. J. Just when and by what means it was first brought into this country will of course never be known. It has, however, become widely diffused over the United States, as indicated

¹ *Stones hispidulus* Fab.

NOTE.—In this bulletin attention is directed to the serious injury to clover and alfalfa caused by the clover-root curculio, and a description of the insect, its feeding habits, and remedial and preventive measures are given.

on the accompanying map (fig. 1), showing its known distribution up to the present time.

Several years ago studies were made of the insect and its attacks upon clover, although up to that time it had not been known to destroy this crop, or even to affect it seriously. Apparently, however, it was likely to become sufficiently abundant at any time to work serious injury, and for this reason Mr. V. L. Wildermuth, an assistant in cereal and forage insect investigations, prepared a paper which was published on March 7, 1910, as a bulletin of the Bureau of Entomology.¹ At that time there had hardly sufficient evidence accumulated to give this paper any considerable economic importance. It seems, however, that injuries that had either remained unnoticed or else had been placed to the credit of some other pests were partly or wholly due to

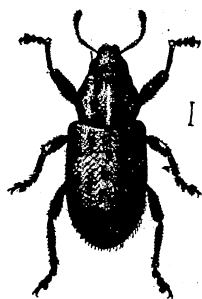


FIG. 2.—The clover-root curculio: Adult. Greatly enlarged. (From Wildermuth.)

the work of the larva or grub of this beetle. As this insect shows a disposition to occur in continually increasing abundance along roadsides and in clover fields, and as it has, during the last year, been found to commit serious depredations in fields of alfalfa, it seems desirable that printed information be made available for distribution among farmers, who are likely to suffer more or less from ravages of the pest.

WHAT THE INSECT IS LIKE.

The fully developed insect is a beetle (fig. 2) which attacks the leaves of clover (fig. 3, *b*) and alfalfa. The line at the right of figure 2 shows the natural length of the beetle, and the eaten leaves (fig. 3, *b*) are plainly to be seen, especially during September

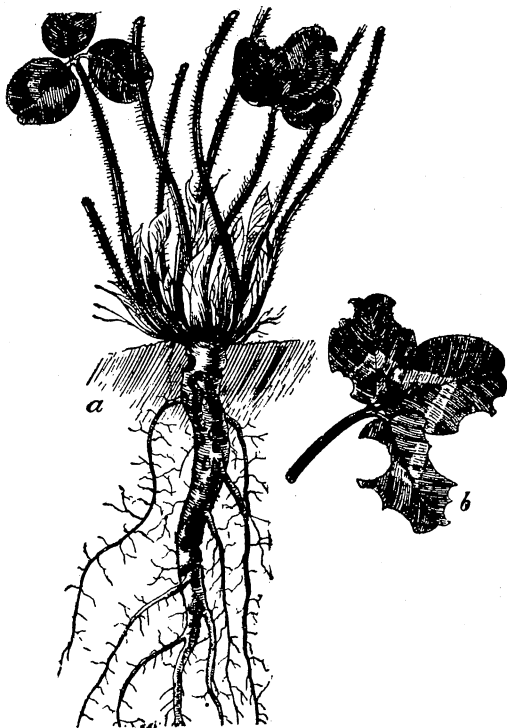


FIG. 3.—The clover-root curculio: *a*, Red clover root showing effects of attack by larvæ; *b*, red clover leaf showing work of adults. About natural size. (From Wildermuth.)

especially during September

¹ Wildermuth, V. L. The clover-root curculio (*Sitones hispidulus* Fab.). U. S. Dept. Agr., Bur. Ent., Bul. 85, Pt. III, p. 29-38, fig. 15-19, March 7, 1910.

and October. They are particularly noticeable along roadsides, and the writer recently observed that in many cases the majority of the clover leaves in Middletown Valley between Mount Catoctin and South Mountain, Md., were eaten in this way, although the injury was not so noticeable in the clover fields adjacent. The most serious injury, however, is not to be charged to the beetle itself, but to the larva or grub.

The eggs (fig. 4) are almost spherical, minute, and when first deposited are white, but after 24 hours change to a jet black. These eggs hatch to an almost equally minute white larva (fig. 5), the head of which is of a light chocolate brown. These grubs are without feet and therefore can not travel about readily. It is in this stage that the insect attacks

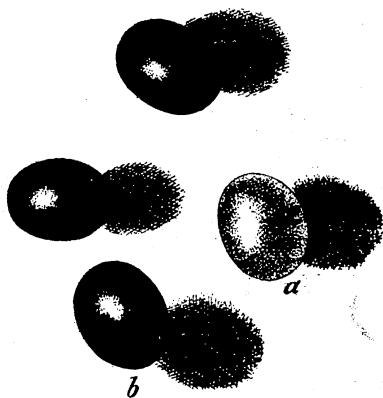


FIG. 4.—The clover-root curculio: a, Egg immediately after deposition; b, egg one day after deposition. Greatly enlarged. (From Wildermuth.)

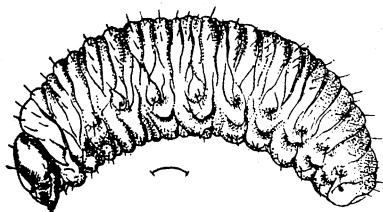


FIG. 5.—The clover-root curculio: Larva. Greatly enlarged. (From Wildermuth.)

the roots of clover and alfalfa and is particularly injurious. When this grub becomes full grown it passes from the grub stage into what is known as the pupal stage (fig. 6) during which it requires no food and consequently is not then injurious.

SEASONAL HISTORY.

The clover-root curculio, as stated

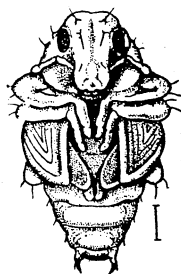


FIG. 6.—The clover-root curculio: Pupa. Greatly enlarged. (From Wildermuth.)

by Mr. Wildermuth, hibernates in the beetle form, hiding itself under rubbish and leaves on the surface of the ground, probably going into hibernation, in the latitude of Washington, some time in November. These beetles remain in their winter quarters until the first warm days of spring, when the females begin to lay their eggs upon the plants on the roots of which the young grubs are to feed. That these operations begin at the earliest possible date is shown by the fact that beetles were observed pairing near Hagerstown, Md., by Mr. H. L. Parker, on September 12, 1914, while Mr. Wildermuth found that beetles taken from the fields in October or November and kept in a warm room would produce eggs almost immediately; or if they are brought in during the winter, the same thing is observed to take place. No eggs or oviposition have been observed in the fields in the fall.

According to Wildermuth:

* * * the female deposits a large number of whitish eggs promiscuously on the leaves and ground or even on the side of the cage when confined. In the field eggs were found adhering to the lower leaves of both red clover and alfalfa. Within less than a day these eggs change in color to a shining black. It is very probable, however, that in the natural state the eggs are usually deposited at or near the surface of the ground. The egg period is 13 days in duration. The larvæ immediately after hatching go down into the ground. Great trouble was experienced in getting eggs to hatch in rearing cages, and it seems from this that there may possibly be some other as yet unknown condition entering into egg deposition in the field.

The adult beetle endeavors to escape injury or capture by feigning death. If a clover plant upon which this beetle is resting be touched the beetle drops to the ground and lies there an inactive and almost invisible object. It is only when in motion that one is able to see it readily, since its color harmonizes so well with its surroundings.

The larval period varies from 17 to 21 days, the latter being apparently nearer the normal.

The pupal stage is passed in an earthen cell, which is oval in outline, about three-sixteenths of an inch (5 mm.) long, and half as large in diameter. The time required for the pupal stage is from 8 to 10 days, easily determined independently of the other two stages by collecting mature larvæ in the field and rearing them to adults.

The larval period was determined by getting the combined length of the egg, larval, and pupal periods and subtracting from these the number of days required for the egg and pupal stages. This method was followed because of the difficulty experienced in getting the newly hatched larvæ to live after being transferred from the vial in which the eggs were hatched to a clover plant on which they could feed, and also because of the fact that the more fully developed larvæ, when disturbed to any extent, nearly always died. Thus, to avoid this, a record was kept of the day of the egg deposition in a certain cage, and then the beetles were removed and the cage left undisturbed but watched carefully until adults appeared. The time required for this was from 38 to 43 days, thus making from 17 to 21 days for the larval stage.

It will therefore be seen that there is but one generation of this beetle annually in the North, but the fact that adults readily deposit eggs at any time after October or early November if placed in a warm room would indicate that there might be more than one generation in the warmer portions of the country, although of course this does not necessarily follow.

FEEDING HABITS.

The feeding habits are, so far as can be determined, almost exactly the same on alfalfa as upon clover. So far as the beetles are concerned the amount of food consumed is almost a negligible quantity, and it is only where they gather upon clover plants along roadsides that this sort of injury becomes conspicuous. In confinement Mr. Parker found that the beetles preferred alfalfa leaves to those of red clover, eating them more readily. So far as it has been possible to determine, the larvæ have precisely the same feeding habits on alfalfa that they have upon clover. Therefore the statements of Mr. Wildermuth which follow are as applicable to the one plant as to the other, and they are quoted herein in full.

The larvæ of this beetle feed on the roots of all the plants mentioned as food plants. The smaller, more tender, or fibrous roots are eaten by the younger larvæ which, as they become more mature, attack the larger roots. Large cavities are eaten along the main roots, and often these are in the form of a groove containing the feeding larva [fig. 3, a]. An examination of clover roots, made on September 23, showed clearly the after effects of the work of the larvæ. The roots were eaten at various places, some of them appearing as though the whole surface had been eaten off, the roots being scabby and brown, the damage having evidently been done during late spring or early in the summer.

The adults feed on the leaves, eating out irregular patches from the margin of the leaf [fig. 3, b]. They are not as hearty eaters as some of the allied species of beetles that live on clover, and hence their work is not so noticeable, except when the beetles have developed in excessively large numbers, as was the case at Corning, N. Y.

FOOD PLANTS.

The following paragraphs relating to the food plants of the clover-root curculio are quoted, in substance, from Mr. Wildermuth:

While the clovers seem to provide the natural food plants of this insect, there are reasons for believing that others may in future be added. This insect, when first observed in this country by Dr. LeConte, was reported by him as present around the roots of grasses growing on sand dunes. Stephens, in 1831, reported it in England as being abundant on sandy heaths, which were no doubt grown up with grass.

The writer, in the spring of 1908, found the larvæ in large numbers in a blue-grass pasture. These were, to all appearances, feeding partly on blue-grass roots, as the only clover present was the white, and this was rather scattering in the field. From this it would seem that some of the grasses may be host plants.

Of the clovers, red clover appears to be the most common choice as a food, while white clover, crimson clover, and alsike clover are all fed upon to a greater or less extent by both the adults and larvæ. Alfalfa seems to be a common food plant for both larvæ and adults. On June 17 the writer collected numerous larvæ from among alfalfa roots in a field at Somerset Heights, Md., and while sweeping over a field of alfalfa with an insect net at Muirkirk, Md., on April 28, experienced no difficulty whatever in securing from six to eight adults with each sweep of the net. It seems likely that, with the increasing acreage of alfalfa, this insect may become a destructive pest and also menace this crop. The fact that alfalfa is always grown continuously on the same land for a fairly long period, from three to six years, or even longer, may greatly accelerate the rapidity with which the insect will be able to increase in numbers.

RECENT DEPREDACTIONS IN ALFALFA FIELDS.

Now it will be noted that at the time Mr. Wildermuth's paper was prepared the insect had not been observed as seriously affecting alfalfa. The first absolute proof that we were able to secure in this direction was on May 29, 1914, when Mr. J. L. Graybill, county demonstrator, of Phoenix, Md., brought to the bureau office specimens of the beetle, and also alfalfa plants that had been irretrievably damaged by some insect, either identical with the larvæ of this species or some other one working precisely like them. Mr. A. B. Gahan was at once dispatched to the infested fields and took up the investigation of the difficulty on June 4. On visiting an infested field it was

found that the hay crop had been cut the previous day and was lying on the ground. There appeared to be a good yield on some parts of the field, but there were many places where the alfalfa plants were very thin and evidently decidedly unhealthy. Upon examining the roots of the alfalfa on these injured areas the main taproots, and often the larger lateral roots, were badly injured. In some cases the injury consisted of a groove, generally of considerable length, up and down the root, but often of a round or oval patch. The injuries appeared to extend to a depth of 4 or 5 inches below the surface of the ground. In one case the taproot of the plant appeared to have been eaten entirely off several inches below the surface of the ground. On digging into the soil, the first shovelful of earth turned up revealed between 12 and 20 larvæ of this insect about the injured roots, and further investigation revealed their presence even more plentifully in other areas of the field. This condition was reported by Mr. Graybill as occurring throughout all parts of Baltimore County, Md.

At the time of this investigation the larvæ (fig. 5) and the pupæ (fig. 6) were present in about equal numbers. That is, the ravages of the pest were subsiding. In all cases both of these stages were within an inch, or at the most an inch and a half, of the surface of the ground. Later on—on July 6—complaints were received, with specimens, from Mr. George A. Billings, of West Chester, Pa. Here again considerable damage had been inflicted upon alfalfa. On consulting with agronomists we have found that either this or a very similar injury to alfalfa has been observed for several years, but no one heretofore appears to have traced this injury to its source.

Mr. C. N. Ainslie found the beetles excessively abundant in alfalfa fields in April, 1910, about Salt Lake City, Utah, but of course at that time the larvæ were not at work upon the roots of the plants, and while during later years other assistants in cereal and forage insect investigations found the adults abundantly in alfalfa fields at various points in Utah, none of them succeeded in securing the larvæ or observing their ravages on the roots. The work of the insect is so obscure that it is likely to escape completely the attention of alfalfa growers.

NATURAL CHECKS.

Our information relative to natural checks, as also that to bird enemies, has not changed materially since the publication of Mr. Wildermuth's paper, and therefore the statements made by him are quoted.

The larva was found to be attacked by a fungus, one of the Entomophthoræ, which no doubt assists in keeping the insects in check. The larvæ, because of their sluggish movements, might be easily captured and fed upon by predaceous beetles, but the fact that the larvæ and pupæ are subterranean in their habits is a semiprotection from parasitic insects as well as from many predaceous enemies. No Hymenopterous or Dipterous parasites were observed.

BIRD ENEMIES.

The Biological Survey, in its work on the food habits of birds, has found that the following birds feed upon the adults of this beetle: Upland plover, killdeer or kill-dee, ruffed grouse, broad-winged hawk, flicker, nighthawk, chimney swift, wood pewee, crow blackbird, meadowlark, Lincoln finch, song sparrow, chipping sparrow, and the white-throated sparrow.

Of these birds the chimney swift and song sparrow were found to be the greatest feeders on the insect, as many as 15 adult beetles being found in the stomach of one chimney swift, while but few less were found in stomachs of song sparrows.

REMEDIAL AND PREVENTIVE MEASURES.

Too short a period has elapsed since we have learned of the present and probably growing importance of this insect in the alfalfa fields to enable us to carry out extensive investigations of remedial and preventive measures.

This insect occurs generally throughout Europe and eastern Siberia as well as in England. It is known to be destructive in Europe to clover, but we have no records of serious damage to alfalfa outside of the eastern United States. Within the last year it has shown itself to be capable of working very serious damage in alfalfa fields and probably has been doing so for years, but on account of the obscure way in which the injury has been done its depredations appear to have escaped attention, although the effects upon the plants seem to have been noticed for a considerable time. If this condition can continue unobserved here in the East, there is no reason why it should not work serious ravages in the alfalfa fields throughout the entire United States where this crop is grown, and the cause of these ravages remain unnoticed even by experts. Now that we understand the nature and cause of these damages to alfalfa, it will be far easier to detect the work of the pest than has been heretofore the case. This bulletin is prepared for the especial purpose of calling the attention of alfalfa growers, county demonstrators, or other agricultural experts to its existence in this country, with the hope that the information will enable them to detect the pest in alfalfa fields and report its presence wherever found and in this way aid in anticipating and preventing as far as possible, by the most practical methods applicable under existing farm conditions, losses that might otherwise occur to alfalfa growers on account of the depredations of the insect in their fields.

Undoubtedly a short rotation of the alfalfa crop will have a tendency to limit the abundance of the pest in the fields. Of course this will not in any way affect the continuous breeding of the insect in waste lands or where clover or alfalfa occur uninterruptedly.

The limited amount of food consumed by the adults would of itself place the application of poisons out of practical consideration.

While the burning over of fields in winter when the ground is frozen might destroy some of the hibernating adults, in many cases they would probably be so near the soil, or so intermingled with the surface soil, as to escape the effects of the burning, and especially would this be true if they were further protected by a covering of matted green grass.

Therefore, at the present time the only practical suggestion that can be made is the disking or harrowing of the fields as soon as the first hay crop is removed. We know that the larvæ as a rule do not descend much more than an inch below the surface. If, therefore, the surface of the ground were disked and then harrowed, it would seem as though the pupal cells would be broken up, and as the pest is helpless in this stage, vast numbers would be destroyed in this way. While, as stated, there has not been sufficient time to carry out any exact experiments in this direction, it would be well for the farmers, until some better methods have been devised, to take the precaution of disking and harrowing immediately after removing the first hay crop in order to destroy as many as possible of the insects in their development. This, of course, can not be done early enough in the season to prevent injury, but it will in all probability reduce largely the abundance of the pest the following season.